Iowa Governor's STEM Advisory Council
Request for Proposals

STEM Businesses Engaging Students and Teachers (BEST) AND STEM Redesigned Learning Environment (RLE)

Background

Executive Order Number 74 signed by Iowa Governor Terry E. Branstad on July 26, 2011, declared that science, technology, engineering, and mathematics (STEM) education should be strengthened as part of providing a world-class education, encouraging innovation and enhancing economic development in Iowa. The STEM Council's priorities for FY2016 include establishing innovative, replicable STEM education models, known as Iowa STEM Businesses Engaging Students and Teachers (BEST) and STEM Redesigned Learning Environments (RLE). Five STEM BEST awards were made in FY2015 that are currently in development [http://www.iowastem.gov/STEMBEST], and four STEM RLE awards were made in FY2014 that are now functioning as models for Iowa [http://www.iowastem.gov/STEMclassrooms].

The STEM Council has designated a portion of the state legislative funding to support the establishment of six new **Iowa STEM BEST** or **STEM RLE** models, one in each of Iowa's six STEM regions [http://www.iowastem.gov/regions]. Although distinct in their missions, both models share the goal of uniting the expertise of public and private sectors to strengthen the continuum from school to careers. Awarded applicants will receive $25,000 to be matched with local cost-share and will be designated as innovative partners of the Governor's STEM Advisory Council modeling excellence.

I. Introduction

A hallmark of Iowa STEM education is the connection of classroom learning to meaning beyond the school walls. A consensus definition for STEM is instrumental in guiding programs and proposals under the STEM Council:

> (STEM is) *"…an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering and mathematics in contexts that make connections between school, community, work and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy."*
>
> *—Tsupros, N., Kohler, R., & Hallinen, J. (2009). STEM education: A project to identify the missing components. Intermediate Unit 1: Center for STEM Education and Leonard Gelfand Center for Service Learning and Outreach, Carnegie Mellon University, Pennsylvania.*

The STEM Council has defined two models for realizing the STEM vision. Overarching guidelines are provided for consistency and to assist proposers, though ample flexibility in design is permitted and welcome to allow for the organic development of STEM programs matching local strengths, challenges, and resources.

II. Option A – STEM BEST or Option B – STEM RLE

Proposers must make a decision at the outset of this application to either propose a design for a (Option A) STEM Business Engaging Students and Teachers (BEST) model, or (Option B) a STEM Redesigned Learning Environment (RLE) model. To assist in making the determination most suited to local needs and resources, please consider:

OPTION A: STEM BEST

The heart of the STEM BEST model is the centrality of business or industry partner(s) in defining curriculum and work space. Topics and projects are driven by the needs of the business partner(s) in collaboration with educators. Learning spaces are separate and distinct from the standard, school environment—ideally at the business site. Also, STEM BEST models are open to K-12 applicants, but may be best suited to secondary schools since transportation and workplace expectations call for mature and independent

student participants.

Three Key Attributes of the STEM Business Engaging Students and Teachers Model

- **Education Driven by Industry Need**
  - ✓ Real-world industry-led and/or student-led projects that connect students to industry knowledge base
  - ✓ Relevant experiences driven by local need
  - ✓ Regional schools or district clusters collaborate with business and industry to maximize opportunities for students in a cost-effective model
- **Rigorous, Relevant and Dynamic STEM Curriculum**
  - ✓ Instructional strategies foster creativity, innovation, and the "entrepreneurial mindset" through a collaborative, interdisciplinary, and problem-based approach
  - ✓ Driven by 21st century skills informed by current and future workforce needs
  - ✓ Accounts for all learners, especially underrepresented populations
  - ✓ Mastery of Iowa Core demonstrated through a competency based approach
- **Authentic Partnerships**
  - ✓ STEM businesses and organizations
  - ✓ Educational institutions (clusters of schools and/or districts are encouraged)
  - ✓ Higher education institutions and government agencies provide support

Top quality STEM BEST proposals will describe a cohesive plan that attends to the three key attributes, including:

- ✓ Plan for the development of a rigorous and relevant STEM curriculum **(Appendix A)**
- ✓ Organized, well-represented partnership team demonstrating a sustained commitment to the program through various levels of engagement **(Appendix B)**
- ✓ A plan for professional development, utilizing business professionals and educational institutions **(Appendix C)**
- ✓ Description of alignment to current and future district goals related to STEM
- ✓ Financial model
- ✓ Evidence of effectiveness

OPTION B: STEM RLE

The focus of the STEM RLE model is the creation of a re-imagined learning space that reflects the latest thinking in both a physical environment for active, investigative, technologically-enhanced, collaborative, learning and a pedagogical environment supported by an educator fully-prepared to facilitate project-based, authentic learning environment linked to the outside world of STEM professionals and community assets. The STEM RLE was conceived of as a secondary learning innovation, but may function well at the elementary and middle level as well.

Three Key Attributes of the STEM Redesigned Learning Environment

- **Innovative Physical Learning Space**
  - ✓ Technology rich
  - ✓ Collaborative, flexible furnishing supportive of team work
- **Integrated STEM curriculum focused on personalized, deeper learning**
  - ✓ Instructional strategies promoting inquiry, problem-solving, and project-based learning
  - ✓ Authentic assessment, real-world problem solving context
  - ✓ Career and college readiness in STEM fields
  - ✓ Self-directed learning and competency-based education pathways
  - ✓ Mastery of Iowa Core curriculum, with deep integrations of STEM
  - ✓ Focus on the Iowa Core Universal Constructs and characteristics of effective instruction
- **Community Based Partnerships**
  - ✓ Higher education
  - ✓ STEM businesses and community organizations

- ✓ Active learning (informal) education

Top quality STEM RLE proposals will describe a cohesive plan that attends to the three key attributes, including:

- ✓ Plan for the development of an innovative learning space **(Appendix D)**
- ✓ A well, thought-out plan for preparing an integrated STEM curriculum focused on personalized, deeper learning through teacher professional development **(Appendix E)**
- ✓ A plan for engaging community partners, including higher education, business, informal education entities, and so on, in professional development and curriculum design **(Appendix F)**
- ✓ Description of alignment to current and future district goals related to STEM
- ✓ Financial model
- ✓ Evidence of effectiveness

III. Eligibility

All Iowa private and public school districts and buildings serving students in any of grades K-12 are eligible to apply. *For STEM BEST, clusters of schools and/or districts are encouraged.*

IV. Timeframe and Selection Process

July 6, 2015:	Request for Proposal Release
August 3, 2015, 3:00 PM:	Webinar for Potential Applicants Details will be announced at www.IowaSTEM.gov
September 1, 2015, 5:00 PM:	Proposal Due
September—October, 2015	Proposal Review All proposals submitted in accordance with this RFP will be reviewed by a Selection Committee consisting of regional STEM advisory boards or subsets thereof. The committees may opt to conduct site visits as part of their proposal evaluation process. A state review committee may be convened for final recommendations.
November 2, 2015:	Award Recipients Announced The STEM Council executive committee will determine final awardees based upon the recommendation of each Selection Committee of each region. The recipients will be rated according to the criteria described in this document.
Winter—Spring, 2015-16:	STEM RLE—Design, Build, Equip STEM BEST—Program Planning; Pilot implementation *Recipients must fully expend the grant funds by June 30, 2016*
Summer 2016:	Self-Assessment and Fall Planning (template to be provided)

V. Funding and Cost Share

The STEM Council commits $25,000 to each STEM region for the support of one innovative STEM education model—STEM BEST or STEM RLE. [*The STEM Council reserves the right not to fund any proposals in any given region where standards of excellence are not met.*] **STEM grant funds must be fully expended in FY2016** (by June 30, 2016). A matching investment of $25,000 in new funding or as in-kind support is required of the applicant.

- OPTION A—STEM BEST ~ up to $25,000
  - **Curriculum Development**
    Project proposal may include costs for curriculum development, working closely with business and industry partners.

- **District Team Site Visits**
  Proposal may include travel expenses for district teams or designees to visit one or more exemplary BEST school model(s) to benchmark and research key criteria.
- **Participation in statewide STEM BEST convening or similar program**
- **Needs Assessment**
  Community surveys of students, parents, business, and industry
- **Direct and Indirect Costs**
  Facility development, technology, liability, and insurance
- **Professional Development (PD) for STEM teachers and partners**
  Proposal may include costs to provide training in collaborating with business professional partners, in the use of project-based learning, career education, and STEM professional development (see Appendix C).
- **Coordinator and Business Development Support**
  Project coordinator, staffing.
- **Other unforeseen costs may be allowed subject to approval**
  Questions on budget or other aspects of this RFP may be directed to Info@IowaSTEM.gov. All questions/answers will be publicly posted at www.IowaSTEM.gov.
- **Cost sharing is required—please detail amount, source(s), and uses.**

- OPTION B — STEM RLE ~ up to $25,000
  - **Furniture, technology, and equipment costs associated with a RLE (see Appendix D)**
    Proposal may include classroom furniture, bandwidth expansion, software, equipment, technology, or other operational or infrastructure costs associated with the redesigned learning environment.
  - **District Team Site Visits**
    Proposal may include travel expenses for District Teams or designees to visit one or more exemplary STEM school model(s) to benchmark and research key criteria.
  - **Professional Development (PD) for STEM teachers and partners**
    Proposal may include costs to provide training in the use of redesigned learning environments, and STEM professional development. Project proposal may also include costs for curriculum development.
  - **Other unforeseen costs may be allowed subject to approval**
    Questions on budget or other aspects of this RFP may be directed to Info@IowaSTEM.gov. All questions/answers will be publicly posted at www.IowaSTEM.gov
  - **Cost sharing is required equal to the amount requested—please detail amount, source(s) and uses.**

VI. Proposal Content Requirements

Format

Page Limit: 9 (This does not include cover or commitment letters)
Spacing: Single-spaced
Margins: Minimum of 1-inch margins

Proposal Components:

- ✓ A singular proposal for the school or district or cluster must provide:
  - Cover Form (with each Superintendents' signatures) (Appendix L)
  - Description of community, district(s), and school(s) demographics (1 page)
  - Description of current STEM education in applying school(s) or district(s) (1 page)
- ✓ Evidence of plan to implement elements #1-7 as described below (6 pages)
- ✓ Statement of school/district/cluster goal or vision with the proposal's pilot implementation (Summer, 2016) (1 page)
- ✓ Commitment Letters defining the role of… (not included in page count)

_____Area Business Partner(s)
_____Higher Education Partner(s)
_____Other relevant contributors: Community, Extension, Nonprofit, etc.

VII. Proposal Elements 1–7

OPTION A – STEM BEST

1.	STEM Curriculum: Proposal demonstrates plans to create and implement an integrated business and industry driven STEM curriculum, aligned to Iowa Core with a focus on personalized, deeper learning to students in any of grades 9-12. Curriculum proposal includes elements to increase participation of underrepresented groups in STEM (females, ethnic/racial minorities, students with disabilities) and proposes the integration or merging of disciplines beyond STEM to include the arts and culture when possible and appropriate. See **Appendix A** for specific descriptions of a STEM curriculum.
2.	Community Partnerships: Proposal provides evidence (including letters of commitment) of strong partnerships and collaboration with: a) Public and Private Sector Business and Industry Partner(s) b) Economic and Workforce Development Groups *(optional)* c) Higher Education Partner(s), including community college, private college, university d) Other Relevant Contributors, including Intermediaries, Extension, etc. Commitment letters clearly discuss the role(s) each partner will play. See **Appendix B** for specific descriptions of community partnerships.
3.	Professional Development: Documentation of team training plan, which includes commitment to engage business and education professionals in collaborative curricular and pedagogical approaches. **Professional development must include both business partner support in working with youth, as well as educator support in linking content to industry needs.** See **Appendix C** for professional development description.
4.	Sustainability Plan: Proposal describes STEM BEST alignment to current district(s) goals and improvement efforts. Proposer should also include information about school district(s) demographics, student enrollment, and demographic targets for the STEM BEST program, and program leadership structure. Detail the continuation of the program beyond the grant period, including willingness to function as a model for others.
5.	Financial Model: Proposal includes detailed budget, including assurances that the school district(s) have/has received commitments of sustained and verifiable fiscal and in-kind support from regional education and business entities. Plan should include information aligned to planning and implementation allowables as outlined in **Part IV**. Requested amount needs to be cost-efficient for the scope of work proposed and cost-sharing must be documented.
6.	Model/Disseminate: Proposer should commit to and list tactics for promoting the model to other districts and partners in the region, to serve as an advocate, and to disseminate related information.

7.	Self-Evaluation: Proposer is responsible for evaluation in consultation with the STEM Council. (A template will be provided.) Final award recipients will: • Manage project outcomes and deliverables with the support of the STEM Council throughout the program period • Execute ongoing monitoring of the project implementation and work with the STEM Council • Collect observational and qualitative data through site visits, classroom observations, administrator and faculty interviews, and student and parent focus groups • Provide administrative data which may include but is not limited to the following: o **Student Targets** ▪ Professional Skills ▪ Attendance ▪ Client feedback ▪ Feedback from internship sponsors (if opted) o **Operational Targets** ▪ Enrollment ▪ Number of mentors and business partners ▪ Curriculum ▪ Budget o **Customer Satisfaction Targets** ▪ Students ▪ Parents ▪ Business Partners/Mentors ▪ Teachers ▪ Administrators and Counselors ▪ Other stakeholders and partners o **School system impact targets** ▪ Instructional changes ▪ Curriculum ▪ Assessments ▪ Attendance ▪ Student Achievement

OPTION B – STEM RLE

1.	Redesigned Learning Environment: Proposal demonstrates operational plans that account for physical space, technical support, and operational system capacity including physical space, equipment, bandwidth, software, and infrastructure. The end goal is to create environments that allow for the broadest possible interactivity among students, teachers, and on and off-site partners. See **Appendix D** for specific description of the STEM Redesigned Learning Environments.
2.	STEM Curriculum: Proposal demonstrates plans to create and implement an integrated STEM curriculum that includes the integration or merging of the arts and culture when possible and appropriate and aligns to the Iowa Core, with a focus on personalized, deeper learning to students in any of grades 6-12. See **Appendix E** for specific descriptions of a STEM curriculum.
3.	Community Partnerships: Proposal provides evidence (including letters of support or commitment) of strong partnerships and collaboration with: a) Higher Education Partner(s), b) Private Sector Business Partner(s) and c) Informal or Active Learning Partner(s)

	See **Appendix F** for specific descriptions of community partnerships.
4.	**Budget and Cost Share:** Proposal includes a detailed budget with assurances that the school has received commitments of sustained and verifiable fiscal and in-kind support from regional education and business entities. The budget may include equipment, furniture, technology, travel expenses for team site visits (in-state or out-of-state), and professional development (please describe).
5.	**Professional Development:** Documentation of the staff training plan, which includes commitment to utilize specific training in the use of Redesigned Learning Environments.
6.	**Model/Disseminate:** Proposer should commit to and list tactics for promoting the model to other districts and partners in the region, to serve as an advocate, and to disseminate related information.
7.	**Evaluation:** Proposer is responsible for evaluation in consultation with the STEM Council's evaluation team. Final award recipients will: • Manage project outcomes and deliverables with the support of the STEM Council throughout the program period • Execute ongoing monitoring of the project implementation and work with the Evaluation Team of the STEM Council • Collect observational and qualitative data, through such data collection activities as site visits, classroom observations, administrator and faculty interviews and student focus groups. • Provide administrative data regarding teachers and students, which may include but is not limited to the following: ▪ Teacher observations and training data ▪ Student and teacher attendance data ▪ Standardized test results and grades

APPENDIX A: STEM BEST Curriculum

Iowa STEM BEST programs will inspire innovative, lifelong learners within interdisciplinary environments, stimulating constructive connections between their life and the real world. A robust STEM curriculum that is both relevant and dynamic and focused on personalized, deeper learning will include:

- Mastery of STEM focused, business-driven, academic curriculum, including integration into Iowa Core subjects
- Self-directed learning and competency-based education pathways[1]
- Reformed instructional strategies and project-based learning
- Focus on the Universal Constructs[2]
  - Critical thinking
  - Complex communication
  - Creativity
  - Collaboration
  - Flexibility and adaptability
  - Productivity and accountability
- Authentic assessment
- Career and college readiness as key outcome
- Integration of the arts and culture curriculum when appropriate

Successful models of Iowa STEM BEST engage business, economic and workforce development, and higher education in curriculum development through a process called rapid prototyping. This process, based off of standard industry practice, allows for multiple, quick iterations to address changing, local needs. Curriculum development via rapid prototyping, as well as academic

[1] STEM Learner Readiness for Post-Secondary and Career Committee, prepared for Advisory Council, 2011.
[2] http://educateiowa.gov/index.php?option=com_content&view=article&id=2089

strands (engineering, healthcare, entrepreneurship, etc.), provides an opportunity for public and private sector partners to engage with students through mentorship, projects, speakers, instructors, and internships.

Overall, successful STEM curriculum must be academically rigorous, inquiry and problem-based, real-world, competency-based, and incorporate academic and career-related knowledge and skills.

APPENDIX B: Community Based Partnerships

The challenges faced by today's schools are numerous and complex. Effective partnerships are a proven solution to these mounting challenges and can bring relevance and rigor to students' learning environments. In order for partnerships to be successful, all stakeholders must be focused and committed. All partners must be willing to invest the time, energy, and resources to learn about each other's needs, to understand the issues, and to build a trusting relationship. Partners must be willing to commit to long-term engagement and advocate for the collaboration and its desired outcomes yet be flexible to optimize efficacy.

Potential partners described here include business and industry, community college intermediaries, higher education, extension, economic and workforce development groups, and chambers of commerce along with the STEM Council's Regional STEM Manager Network, which can be found here.

Local and Regional Business Partners

As the U.S. Chamber of Commerce's Institute for a Competitive Workforce states, "The business community is the number one consumer of the public education system and therefore must be involved and engaged stakeholder in the education of America's children." Businesses success depends on a well-educated and adaptable pool of young talent emerging from America's high schools and colleges to maintain stability and growth. The resources, skills, and knowledge businesses and their employees bring to the table have broad significance for ensuring young adults reach their full potential. As it might be expected, there is no single framework for a school-business partnership. Partnerships between education and the business community can:

- Provide work-based learning experiences that transfer knowledge and skills between the classroom and the work setting
- Help schools build career cultures that empower students
- Help educators align curriculum to business needs
- Build meaningful relationships with mentors
- Provide tours, speakers, and facilities
- Provide funding and equipment for classrooms and workspaces

Iowa STEM BEST schools must build meaningful partnerships with community business partners as a mechanism to ensure career and college readiness for all of Iowa's young people. One measure of success will be an increase in the number of Iowa students who can demonstrate their qualifications on the National Career Readiness Certification[3] exam. In collaboration with the Iowa Workforce Development, the Skilled Iowa initiative seeks to promote the NCRC as an "industry-recognized, portable, evidence-based credential that certifies essential skills needed for workplace success."[4]

Economic and Workforce Development Partners

A compelling body of research links primary and secondary education to economic development and growth. The foundation of STEM BEST programs is the connection between secondary education and local economic and workforce needs. Successful implementation requires districts to identify local workforce needs as a driving force for curriculum, course strands offered, program focus, etc. As workforce needs change, districts must continue to evaluate their programs to reflect these trends.

School District Clusters

To provide students with experiences and opportunities that are sustainable, school districts are encouraged to investigate a shared STEM BEST program (Cluster/Hub). Examples of cluster partnerships were awarded previously and can be accessed at www.IowaSTEM.gov/STEMBEST. Collaboration across school districts fosters the sharing of best practices and a team approach to student achievement, while at the same time maximizing business and community resources.

Higher Education Partners

[3] http://skillediowa.org/

[4] Skilled Iowa Report, 2012, Iowa Workforce Development in Partnership with ACT.

The role of higher education in the STEM BEST model may most prominently be in the form of conversations and guidance. Post-secondary enrollment, concurrent enrollment, and career academies serve both rural and urban schools. How these factor in to the BEST experience will be an important consideration. Additionally, partnership between institutions of higher education and STEM BEST programs may include exploring new strategies to strengthen ties and to extend learning opportunities for all students. Higher Education partners may wish to extend dedicated professional time (FTE) to work with the applicant district to provide professional development, curricula development, or business engagement. Direct higher education resource professionals include the STEM Council's Regional STEM Managers [http://www.iowastem.gov/regions], who can provide access and links to higher education representatives and the Community College Intermediaries who currently coordinate regional placements for job shadows, internships, and industry tours among other career-focused programming (a list of state-wide intermediary contacts can be found here).

APPENDIX C: Professional Development

Professional development for the STEM BEST model should encourage and offer opportunities for business and education professionals to work alongside each other in an interdisciplinary, community-driven, and problem-based approach. *Professional development must include both business partner support in working with youth, as well as educator support in linking content to industry needs.*

Programs that engage educators in industry-based learning opportunities allow them to see workplace skills and how they can be integrated into real-world problem coursework to enhance professional development. Interdisciplinary teams, including business and education professionals, should work together to embed industry experiences and best practices into curriculum and pedagogy.

APPENDIX D: Innovative Learning Space

STEM education is inherently different from traditional, lecture-driven teaching and learning. STEM is *"…an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering and mathematics in contexts that make connections between school, community, work and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy."*[5]

STEM is interactive, dynamic, collaborative, inquiry driven, multi-disciplinary, and student-centered. Technology must be seamlessly embedded and ubiquitously available to both teachers and learners. Workspaces facilitate pathways of communication and creativity. A STEM learning environment encourages tangential discoveries and multi-faceted decision-making. STEM exploration results in spontaneous creating, building, making, and doing. As educators begin to understand STEM as a pedagogical approach, the need for redesigned learning environments to support a new way of teaching and learning becomes clear.

A considerable body of research exists to support the assertion that redesigned learning environments promote out-of-school partnerships, peer teaching, and active learning. STEM learning environments may require a full or partial re-design of existing traditional lecture-based classrooms. The traditional setting for learning is the lecture-centered classroom. For schools interested in investing in new educational spaces for STEM teaching and learning, the challenge is obvious: the future of STEM simply cannot fit into a 19th century container. Traditional classrooms with teacher-centered lecture stations, desks, chairs in rows (designed to keep kids still and quiet), and technology designed only for the teacher's use will not allow STEM to flourish.

Iowa needs educators, scientists, architects, engineers, artists, technologists, designers, and learners to collaborate and re-envision the learning environment needed to support STEM pedagogy. For instance, furniture should be easy to reconfigure, allowing for diverse teaching methods, including project-based learning, blended learning, or direct instruction. The teacher should be able to facilitate whole group learning, small group work, or individualized study. Freedom of movement for both learners and teacher is essential.

In a redesigned learning environment, technological assets are situated primarily for student use. The goal of interactive technology in a STEM classroom is to empower teachers and students who can work toward personalized learning goals. Integrated technology use connects students with information systems, models, databases, and remote STEM experts. Technology can

[5] Tsupros, N., Kohler, R., & Hallinen, J. ,2009, in *STEM education: A project to identify the missing components*, Center for STEM Education and Leonard Gelfand Center for Service Learning and Outreach, Carnegie Mellon University, Pennsylvania

facilitate mentoring programs or allow access to social networking resources for STEM ideas during and outside the traditional school settings. Technology in redesigned learning environments can flatten traditional hierarchies.[6]

Current Iowa Models of Redesigned Learning Environments

The **University of Iowa** has invested in T.I.L.E. (Transform, Interact, Learn, Engage) classrooms, which increase conceptual understanding among learners and decrease failure rates, especially among women and minorities (groups that are traditionally underrepresented in STEM).

At the University of Iowa, T.I.L.E. classrooms are equipped with the following:

T.I.L.E. Classroom Technology Components

- Large monitor display for each student table
- Large screens and projectors that allow viewing of an image by the entire class
- Switching technology controlled by the instructor, allowing the instructor to switch images between many different monitor locations
- Network connectivity (wireless or wired, as appropriate) for student computers (personally owned or supplied by the school)
- Microphones available at each table in larger rooms
- Additional technology as needed to supply presentation and multi-media content (DVD or Blu-ray players, document cameras, etc.)
- Monitors for instructors to provide annotation capability, etc.

T.I.L.E. Classroom Furnishing Characteristics

- Instructor podium that does not dominate the classroom, nor is there an obvious space that represents the traditional front of the room
- Room furnishings designed to promote student collaboration
- Chairs that are movable
- Tables and writing surfaces allowing students to work in small groups
- Ample surfaces for student work (whiteboards, glass boards or slate boards)

The **University of Northern Iowa** has also invested in Models of redesigned learning environments. One of the UNI Models is called the Transformative Education Environment or T.E.E. The **T.E.E. Model** is set up to maximize flexibility in terms of how the students in the classroom can interact with each other. The room is flexible with light-weight tables and chairs on wheels. Robust, wireless capabilities allow students to connect to large displays to complete group collaborative activities. The facilitation of project/problem-based learning is the central focus of the T.E.E. learning environment that can be changed to meet the varying needs of teachers and learners.

Another UNI Model is the **CAT Classroom.** The CAT (Collaborative, Active learning, Transformational) Classroom is based on a commitment to an active-learning, pedagogical philosophy that infuses technology into collaborative learning spaces. It is designed to foster collaboration and student interaction with students and faculty in an effort to enhance student learning outcomes. A CAT Classroom contains round tables that seat six students each with the instructor's station at the center of the room. The room has a Smart Board at the instructor's station, and each table has networked laptops and its own dedicated wall mounted monitor that can display data from a laptop on the table, the instructor's screen, or work from other laptops around the room. UNI continues to research and invest in **various models** of redesigned learning environments always focusing on the most cost-effective and efficient ways to design learning environments to enable faculty to utilize active learning strategies to maximize student learning.

At **Iowa State University**, a classroom design partnership has been created between the local facility management, information technology, and faculty development support groups. Through this partnership, facility design, remodeling, and management has

[6] Lynch, Sharon J; Behrend, Tara; Burton, Erin Peters; "Inclusive STEM Focused High Schools: STEM Education Policy and Opportunity Structures". Paper prepared for the NARST 2013 Annual International Conference in Puerto Rico, April 6-9, 2013.

taken on multiple approaches for active learning classrooms, often tailored specifically for an academic discipline that will be the classroom's primary user.
Active learning classrooms now exist on the ISU campus, ranging from technology-rich facilities to economically-minded classrooms that still promote active learning through furniture layout, pedagogical best practices, and moderate levels of technology. Team-based learning theory drives some of the active learning classroom design at ISU. For information or assistance at ISU on the development of active learning classrooms in support of STEM, contact Jim Twetten, Director, Academic Technologies at jtwetten@iastate.edu or 515-294-2317.

In redesigned learning environments, there is an ongoing shift towards **personalized learning within a dynamic setting**. Classrooms transition to a studio environment where students are engaged in theme-based content, pursuing individual or group interests. Utilization of online and other interactive software will create capability for both teachers and students to interact with others at remote locations—giving the broadest definition of interactivity.

Differentiated instruction becomes the norm rather than the exception in a redesigned classroom—with a positive impact in engaging all learners. Thus, contemporary classroom environments become more inclusive-learning settings for exceptional learners, students with disabilities, and English Language Learners because they promote peer-to-peer, group, and teacher collaboration throughout the entire learning experience. This STEM school vision encompasses all learners in the state, seeking to include high ability, underrepresented, and nontraditional students in STEM exploration and enrichment.

APPENDIX E: Integrated STEM Curriculum – Personalized, Deeper Learning

Iowa STEM Learning Environments will inspire innovative, lifelong learners within interdisciplinary environments, stimulating constructive connections between seemingly abstract concepts and encouraging insightful leadership via technology-rich, real-world academia anchored by global literacy. A robust STEM curriculum, focused on personalized, deeper learning will include:

- Mastery of STEM focused, academic curriculum, including integration into non-STEM subjects
- Self-directed learning and competency based education pathways[7]
- Reformed instructional strategies and project-based learning
- Focus on the Universal Constructs[8]
    - ✓ Critical thinking
    - ✓ Complex communication
    - ✓ Creativity
    - ✓ Collaboration
    - ✓ Flexibility and adaptability
    - ✓ Productivity and accountability
- Authentic assessment
- Career and college readiness as key outcome
- Integration of the arts and culture curriculum when appropriate

Integrated STEM teaching and learning makes explicit what is too often implicit in how experts across STEM disciplines construct, apply, and create knowledge. First, an integrated STEM curriculum will help shape student decision-making related to career choice and civic life. An integrated approach to the STEM and non-STEM disciplines will result in a **re-imagined use of *time* in school**, allowing students to engage with core content in novel and deeper ways. Students will be encouraged to deploy tools and technologies that build local system capacity while retaining the perspective of global citizenry. The curricular integration that is closely tied to STEM studies "assists students to transfer knowledge, helps them to focus on big ideas, and increases motivation to learn."[9]

Second, an integrated STEM curriculum will facilitate **practices of global citizenry** on issues of deep complexity. The science, social science, and engineering communities have documented many of the grand challenges[10] of our time (i.e., energy, food,

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[7] STEM Learner Readiness for Post-Secondary and Career Committee, prepared for Advisory Council, 2011.
[8] http://educateiowa.gov/index.php?option=com_content&view=article&id=2089
[9] Rennie,L. Veville, G. Wallace, J. (2012). Knowledge that Counts in a Global Community: Exploring The Contribution of Integrated Curriculum. New York, NY: Routledge Taylor and Francis Group.
[10] Grand Challenges in Engineering, http://www.engineeringchallenges.org/

water and cyber security), which will require sustained effort over generations. Finding answers to such ill-structured problems will require intentional cross-curricular links and thoughtfully constructed concepts that reinforce the challenges facing present and future generations. Students will require learning spaces that embrace failure (i.e. experimentation and design) as an important aspect of their academic experience. They will need to develop collaborative skills that mesh physical and virtual environments. Increasingly, students are learning and working in hybrid spaces, "third spaces,"[11] that require unique tools and skill sets.

Finally, it is not enough to provide even the best "in-class" or "stand alone" curriculum. Pedagogical success requires that students **exercise agency (are empowered)** to define the question, test ideas, choose the appropriate resource, and develop solutions as a way of understanding systems (physical, natural, virtual) and their relations. Students must be provided space, resources, and instructional scaffolds that help them develop learning strategies to support their inquiries.

APPENDIX F: Community Based Partnerships

Higher Education Partners

Iowa schools already have well-established pathways of partnership with institutes of higher education. Post-secondary enrollment, concurrent enrollment, and career academies serve both rural and urban schools. However, partnership between institutions of higher education and STEM schools should explore new strategies to strengthen ties and to extend non-traditional, credit earning, or extended learning opportunities for all students. Higher Education partners may wish to extend dedicated professional time (FTE) to work with the applicant district to provide professional development or curricula development.

A variety of "early college" models exist across the nation. Within the context of a STEM learning environment, partnerships with post-secondary institutions need to consider the importance of providing student supports throughout a *blended high school and college* experience. STEM schools must also work to create innovative strategies to better serve the intellectual and developmental needs of underrepresented sub-groups in STEM fields.

Local and Regional Business Partners

Student learning goals and activities can extend beyond the traditional classroom to incorporate real-world learning with local connections. Secondary students may participate in internships, facilitated mentoring programs, and other off-campus learning opportunities. Teachers are encouraged to participate in Iowa's *Real World Externships for Teachers of Mathematics, Science and Technology* supported by the STEM Council. The use of facilitated mentoring programs to build connections between Iowa's students and STEM professionals is encouraged.

Iowa STEM schools must build meaningful partnerships with community business partners as a mechanism to ensure career and college readiness for all of Iowa's young people. One measure of success will be an increase in the number of Iowa students who can demonstrate their qualifications on the National Career Readiness Certification[12] (NCRC) exam. In collaboration with Iowa Workforce Development, the Skilled Iowa initiative seeks to promote the NCRC as an "industry-recognized, portable, evidence-based credential that certifies essential skills needed for workplace success."[13]

Informal Education Partners/Active Learning Partners

Museums, libraries, science centers, and clubs are a few of the informal, educational entities that play a vital role in supporting underrepresented students for STEM. Iowa STEM is committed to the idea that STEM fields present vibrant, life and career opportunities for all students. Informal partners can help to provide bridge programs, tutoring programs, extended school day, and year-round learning with an emphasis on developing a "STEM identity."

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[11] Designing Blended Learning Space to the Student Experience, Andrew J. Milne Tidebreak, Inc. <http://net.educause.edu/ir/library/pdf/PUB7102.pdf>

[12] http://skillediowa.org/

[13] Skilled Iowa Report, 2012, Iowa Workforce Development in Partnership with ACT.

APPENDIX G: STEM BEST PROPOSAL SCORING RUBRIC

CRITERIA	TOP SCORE	COMMENTS
1) STEM Curriculum: Proposal contains evidence that the STEM BEST program will offer a robust, integrated, business driven STEM curriculum with a focus on personalized, deeper learning to students, including the recruitment of students underrepresented in STEM (females, students of ethnic or racial minority groups and students with disabilities) and incorporation of the arts and culture aspects when appropriate. The following key components are addressed: ✓ Driven by 21st century skills informed by current and future workforce needs ✓ Mastery of Iowa Core demonstrated through a competency based approach ✓ Instructional strategies foster creativity and innovation through a collaborative, interdisciplinary, problem-based approach *Reviewers will consider exemplary deployment of key components with a clear link to their connection with innovation and economic interest in the local area,* ***as described in Appendix A.***	20 pts	
2) Community Partnerships: Proposal provides evidence (including letters of commitment) of strong partnerships and collaboration that include all of the following: a) Public and Private Sector Business Partner(s) b) Economic and Workforce Development Partner(s) c) A physical location amenable to ready access to business and industry professionals and facilities and d) Other partnerships, e.g., higher education, nonprofits *Reviewers will look for genuine partnerships inclusive of key stakeholders. Evidence of enthusiastic partner commitment should be demonstrated through letters defining* ***specific, ongoing roles.*** *The partnerships should include involvement in curriculum development and instructional design including business-sponsored projects, mentoring, accelerated learning opportunities, etc.* ***as described in Appendix B.***	20 pts	
3) Financial Model: Detailed budget and assurances that the school(s) have/has received commitments of sustained and verifiable fiscal and in-kind support from regional education and business entities. Budgeted from award date November 2015 to June 30, 2016. Request is cost-efficient for the scope of work proposed. *Rubric score will be dependent upon amount and type of in-kind and financial support from regional industry and educational partners.*	15 pts	
4) Sustainability Plan: Proposal clearly aligns STEM BEST program to district goals and demonstrates commitment to involve underrepresented populations.	15 pts	

5) **Professional Development:** Documentation of a training plan which prepares business and education professionals to implement STEM BEST program. *Top points awarded for proposals which include evidence of strong industry professional/teacher engagement and commitment to an integrated STEM curriculum **as described in Appendix A**.*	10 pts	
6) **Model/Disseminate:** Proposer should commit to and list tactics for promoting the model to other districts and partners in the region, to serve as an advocate, and to disseminate.	10 pts	
7) **Self Evaluation:** Proposal ensures a competent, comprehensive internal program evaluation, both qualitative and quantitative, in cooperation with STEM Council. *Top points awarded to proposals that give clear assurance of capacity and expertise to evaluate, in cooperation with the STEM Council evaluation process.*	10 pts	
TOTAL POINTS	***(100 Points Possible)***	

APPENDIX H: STEM RLE PROPOSAL SCORING RUBRIC

CRITERIA	TOP SCORE	Comments
1) **Redesigned Learning Environment:** Proposal demonstrates operational plans that account for physical space, technical support, and operational system capacity including physical space, equipment, and infrastructure. *Top points will be awarded for proposals which demonstrate commitment to the design and implementation of STEM Learning Environments as described in Appendix D.*	20 pts	
2) **STEM Curriculum:** Proposal contains evidence that the STEM Redesigned Learning Environment will offer a robust, integrated STEM curriculum with a focus on personalized, deeper learning to students, especially inclusive of students underrepresented in STEM (females, students of ethnic or racial minority groups, and students with disabilities) and incorporation of the arts and culture aspects when appropriate. The following key components are addressed: ✓ Mastery of Iowa Core curriculum, with deeply integrated STEM ✓ Self-directed learning and Competency Based Education Pathways ✓ Inquiry Driven Instructional Strategies and Project Based Learning ✓ Focus on the Iowa Core Universal Constructs ✓ Authentic Assessment ✓ Career and College Readiness in STEM fields *Reviewers will consider exemplary deployment of key components with a clear link to their connection with innovation and economic interest in the local area, **as described in Appendix E.***	20 pts	

3) Community Partnerships: Proposal provides evidence (including letters of support or commitment) of strong partnerships and collaboration with: a) Higher Education Partner(s) b) Private Sector Business Partner(s) and c) Non-formal or Active Learning Partner(s) *Reviewers will look for genuine partnerships inclusive of key stakeholders. Evidence of enthusiastic community and Higher Education support and commitment should be demonstrated through letters offering specific, ongoing support, and commitment.* *The partnerships should include involvement in curriculum development and instructional design, including business-sponsored projects, mentoring, accelerated learning opportunities, etc.* ***as described in Appendix F.***	15 pts	
4) **Budget and Cost Share:** Detailed budget and assurances that the school has received commitments of sustained and verifiable fiscal and in-kind support from regional education and business entities. *Rubric score will be dependent upon amount and type of in-kind and financial support from regional industry and educational partners.*	15 pts	
5) **Professional Development:** Documentation of staff training plan, which includes specific training in the use of Redesigned Learning Environments. *Top points awarded for proposals which include evidence of strong teacher leadership and commitment to an integrated STEM curriculum* ***as described in Appendix E.***	10 pts	
6) **Model/Disseminate:** Proposer should commit to and list tactics for promoting the model to other districts and partners in the region, to serve as an advocate, and to disseminate related information.	10 pts	
7) **Evaluation:** Proposal ensures a competent, comprehensive internal program evaluation, both qualitative and quantitative, in cooperation with STEM Council evaluators. *Top points awarded to proposals that give clear assurance of capacity and expertise to evaluate, in cooperation with the STEM Council evaluation process.*	10 pts	
TOTAL POINTS	*(100 Points Possible)*	

APPENDIX I: RESOURCES

STEM Learning Environments Resources
Zitter, I. and A. Hoeve (2012), "Hybrid Learning Environments: Merging Learning and Work Processes to Facilitate Knowledge Integration and Transitions", *OECD Education Working Papers,* No. 81, OECD Publishing. http://dx.doi.org/10.1787/5k97785xwdvf-en <http://www.oecd.org/edu/ceri/Zitter and Hoeve.Hybrid Learning.pdf>
Oblinger, Dianna G.: Learning Spaces, http://net.educause.edu/ir/library/pdf/PUB7102.pdf
Beichner, Robert, University of North Carolina, http://scaleup.ncsu.edu/FAQs.html
"7 Things You Should Know About Collaborative Learning Spaces", Educause Learning Initiative, January 2013. Accessed 4/19/2013 (http://www.educause.edu/library/resources/7-things-you-should-know-about-collaborative-learning-spaces)
S. Van Horne, C. Murniati, J. Gaffney, M. Jessie, Promoting active learning in technology-infused TILE classrooms at the University of Iowa, *Journal of Learning Spaces, 1*, 2, (2012)
Nationally recognized Bob Pearlman on designing new Learning Environments to support 21st Century Learning. Accessed 4/22/2013. <http://files.solution-tree.com/pdfs/Reproducibles_21CS/chap6_designing_new_learning_environments.pdf>
Zitter, I. and A. Hoeve (2012), "Hybrid Learning Environments: Merging Learning and Work Processes to Facilitate Knowledge Integration and Transitions", OECD Education Working Papers, No. 81, OECD Publishing. <http://www.oecd.org/edu/ceri/Zitter and Hoeve.Hybrid Learning.pdf>
Creating Hybrid Spaces for Engaging School Science Among Urban Middle School Girls. American Educational Research Journal. March 2008, Vol. 45, No. 1, pp. 68 –103 <http://lis6609.pbworks.com/f/Science+Urban+Middle+School+Girls.pdf>
Mega M. Subramaniam, June Ahn, Kenneth R. Fleischmann, Allison Druin: The Library Quarterly, Vol. 82, No. 2 (April 2012), pp. 161-182 <http://scidentity.umd.edu/wp-content/uploads/2013/02/libquarterly.pdf>

STEM School Resources
Hewlett Foundation focuses on "Deeper Learning" as a strategy of education reform. See also the Strategic Plan Summary of Hewlett's Educational Program.
North Carolina STEM Learning Network has compiled a list of STEM attributes, and a set of STEM School Rubrics to evaluate STEM schools at the elementary, middle and high school levels.
The Ohio STEM Learning Network advocates five "Platform Design Principles" for STEM schools and hubs.
EdWorks, a subsidiary of KnowledgeWorks, advocates for a STEMLab High School model that emphasizes Problem Based and Inquiry Learning. FastTrack is an early college model that promotes career and college readiness.
P-TECH High School in New York City is garnering national attention as a model partnership between business, K-12 and Higher Ed. The Iowa site visit report highlights of team learning.
"STEM Pathways to College and Career Schools, A Development Guide" is intended to help education leaders at the school and college levels, and business leaders in IT and other sectors, get started on the collaborative process of designing and building a STEM Pathways to College and Careers school (STEM-PCC school).
The Arizona Science Foundation STEM Network created The STEM Immersion Guide, which "offers a roadmap to establish project-based STEM instruction, leadership development and community support. It was created to provide practical direction that can empower teachers and administrators, schools and districts."
Lynch, Sharon J; Behrend, Tara; Burton, Erin Peters; "Inclusive STEM Focused High Schools: STEM Education Policy and Opportunity Structures". Paper prepared for the NARST 2013 Annual International Conference in Puerto Rico, April 6-9, 2013.

APPENDIX J: EXAMPLE EQUIPMENT LIST for STEM RLE

The following list is meant to serve as a *suggestion OR example* of a list for equipping a redesigned learning environment, based on other Iowa models. District proposals may include different equipment, technology, or furniture specific to the proposer's needs. Designers may wish to explore the website www.FLEXspace.org, a free repository of exemplary learning spaces that allows users to log in and view different active learning and STEM-type classrooms across the country.

The following are vendors who have expressed interest in working with schools on redesign. They are not exclusive or preferred by the STEM Council, but merely provided for the benefit of applicants:

DLR Group
Contact: Ken Hagen
Title: Architect
Phone: 515-276-8097
Email: khagen@dlrgroup.com
Website: www.dlrgroup.com
Company Description: By listening to teachers, students, and administration, our architects and engineers design solutions for active learning environments that maximize engagement and collaboration to elevate the learning experience.

IPI
Contact: Andrew Gogerty
Title: Education Specialist Sales Rep K-12
Phone: 515-330-0095
Email: andrew.gogerty@iowa.gov
Web site: www.iaprisonind.com
Company Description: IPI offers quality and affordable school furniture, such as desks, chairs, lockers, library furniture, lounge furniture, STEM furniture, office furniture, and office seating.

Storey Kenworthy
Contact: Ryan Boese
Title: VP of Sales and Marketing
Phone: 515-558-684
Email: eboese@storeykenworthy.com
Website: www.storeykenworthy.com
Company Description: Storey Kenworthy, providing innovative furniture and design solutions for all of your educational needs.

Quantity	Unit	Equipment and Infrastructure	Unit Price	Amount	Reference
		Furniture	In dollars	In dollars	
30	Each	Student Chairs	189	5670	Steelcase.com
6	Each	Student Desk	358	2148	Steelcase.com
1	Each	Coach's Desk	358	358	Steelcase.com
1	Each	Coach's Chair	189	189	Steelcase.com
6	Each	Mobile Whiteboards	629	3774	Steelcase.com
		Equipment			
1	Each	Document Camera	150	150	Touchboards.com
6	Each	SmartDesk or Surface Tables	TBD	0	Smart.com
1	Each	Presentation Monitor or Projector	400	400	NEC
		Software Services			
1	Each	Cloud Storage Service (e.g., Dropbox and Google Drive)	120	120	100 Gig Storage (Dropbox)

30	Each	Open Source Productivity Tools (Google Drive)	0	0	Google
30	Each	Data Visualization & Modeling Tools (e.g.,Tinker Plot, Fathom, Geometer's SketchPad, CAD/CAM)	300	9000	Keycurriculum.com
30		Data Collection Tools (e.g., Pasco or Vernier Probeware)	75	2250	Include a variety of probes based on curricular themes
30	Each	Conferencing Tools (e.g., Skype, Google+, Twitter)	0	0	Skype, Google, Twitter
1	Each	Open Source LMS Infrastructure (e.g., Eliademie, Edmodo)	0	0	Elidemie, Edmodo
		Hardware			
30	Each	A combination of Google Chrome, Surface and/or Mac	800	24,000	HP, Apple

APPENDIX K: Resources for STEM BEST

IOWA STEM BEST ANALOGS
Northland CAPS http://www.northlandcaps.org/s/1625/start.aspx
Waukee CAPS (APEX) http://www.waukeecaps.org/
Park City, UT CAPS http://caps.pcschools.us/
Minnetonka CAPS http://minnetonka.k12.mn.us/vantage
Professional Development Resources *(This list will be expanded on the Iowa STEM BEST website as P.D. opportunities are identified. Please send other relevant STEM BEST supportive models to Info@IowaSTEM.gov)*
Blue Valley CAPS Summer Huddle http://www.bvcaps.org/s/1403/index.aspx?sid=1403&gid=1&pgid=632
Real World Externships for Teachers of Mathematics, Science, and Technology http://www.iowastem.gov/imsep/http%3A/%252Fiowastem.gov/externships
Research Experiences for Teachers at Iowa State University http://www.cbirc.iastate.edu/education/precollege/ret/
STEMInnovator Institute at the University of Iowa http://www.jacobsoninstitute.org/stem_program_institute_2014.html
Additional Resources *(This list will be expanded on the Iowa STEM BEST website as resources are identified. Please send other relevant STEM BEST supportive resources to Info@IowaSTEM.gov)*
P-TECH High School in New York City is garnering national attention as a model partnership between business, K-12 and Higher Ed. The Iowa site visit report highlights of team learning.
"STEM Pathways to College and Career Schools, A Development Guide" is intended to help education leaders at the school and college levels, and business leaders in IT and other sectors, get started on the collaborative process of designing and building a STEM Pathways to College and Careers school (STEM-PCC school).
The Arizona Science Foundation STEM Network created The STEM Immersion Guide, which "offers a roadmap to establish project-based STEM instruction, leadership development and community support. It was created to provide practical direction that can empower teachers and administrators, schools and districts."
Business Engagement http://blogs.edweek.org/edweek/marketplacek12/Business%20Engagement%20in%20Education%20FINAL.pdf http://www.project10.info/files/School-BusinessGuidingPrinciples.pdf

APPENDIX L: COVER FORM

School(s) or District(s) _____

District Superintendent(s) _____

Project Director _____

Lead Contact Information (Project Director unless stated otherwise)
Address: _____
Phone: _____
Email: _____

OPTION PROPOSED

_____ Option A – STEM BEST

_____ Option B – STEM RLE

Statements (to be initialed by District Superintendent(s))

_____I agree to a Selection Committee site visit as a component of the Review Process. Members of the selection committee may conduct site tours, interview relevant school and community leaders or observe brief proposal presentations by students and staff.

_____If selected, the school(s) agree to conduct, in consultation with the STEM Council, a thorough evaluation throughout the term of the program. The evaluation will abide by a template provided by the Council.

Items Included in Proposal:
_____Cover Form
_____Proposal (limit 9 pages not including Cover or Commitment letters)
_____Additional Supporting Documents

Please address questions to
Info@IowaSTEM.gov (All questions/answers will be posted at www.IowaSTEM.gov.)

Submit Proposal by September 1, 2015, 5:00pm to Info@IowaSTEM.gov

Or deliver on a Windows-compatible electronic memory device to
Executive Director Jeff Weld, PhD.
Iowa Governor's STEM Advisory Council
214 East Bartlett Hall, University of Northern Iowa
Cedar Falls, IA 50614-0298